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(54) Television studio apparatus

(57) In a film scanner, functional units 1 to 4 provided for video signal processing are connected in series and are also connected via respective interfaces 9 to 12 to a digital local area network with a serial bus 8 on which there are transmitted data blocks containing control data for the functional units. In the data blocks an SMPTE time code is associated with the control data for the functional units, and the control data for functional unit(s) addressed by a data block is accepted by such unit(s) according to the SMPTE time code value contained in the data block. To maintain accurate timing, functional unit(s) such as frame store 3 which delay the video signal produce modified data blocks for series-connected functional unit(s) such as post processor 4, in which the time code value is delayed by the amount the video signal is delayed in the relevant functional unit.

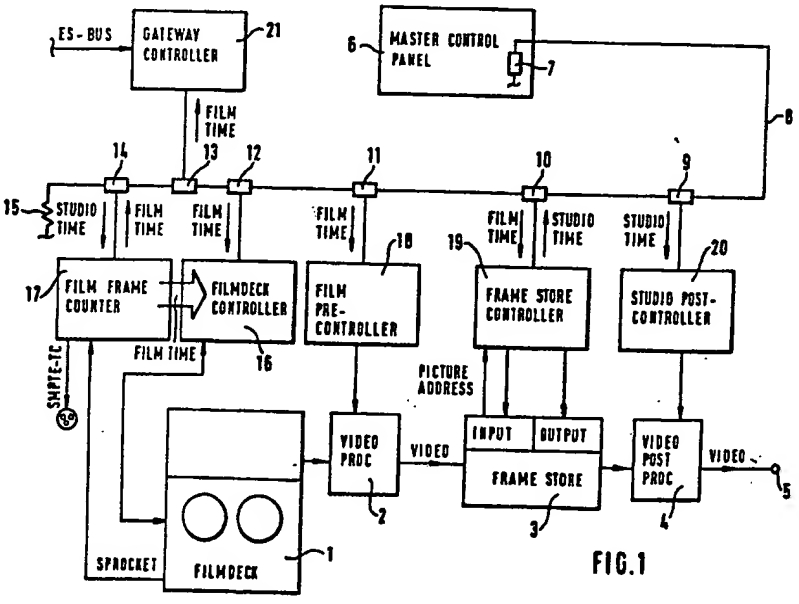

FIG.1

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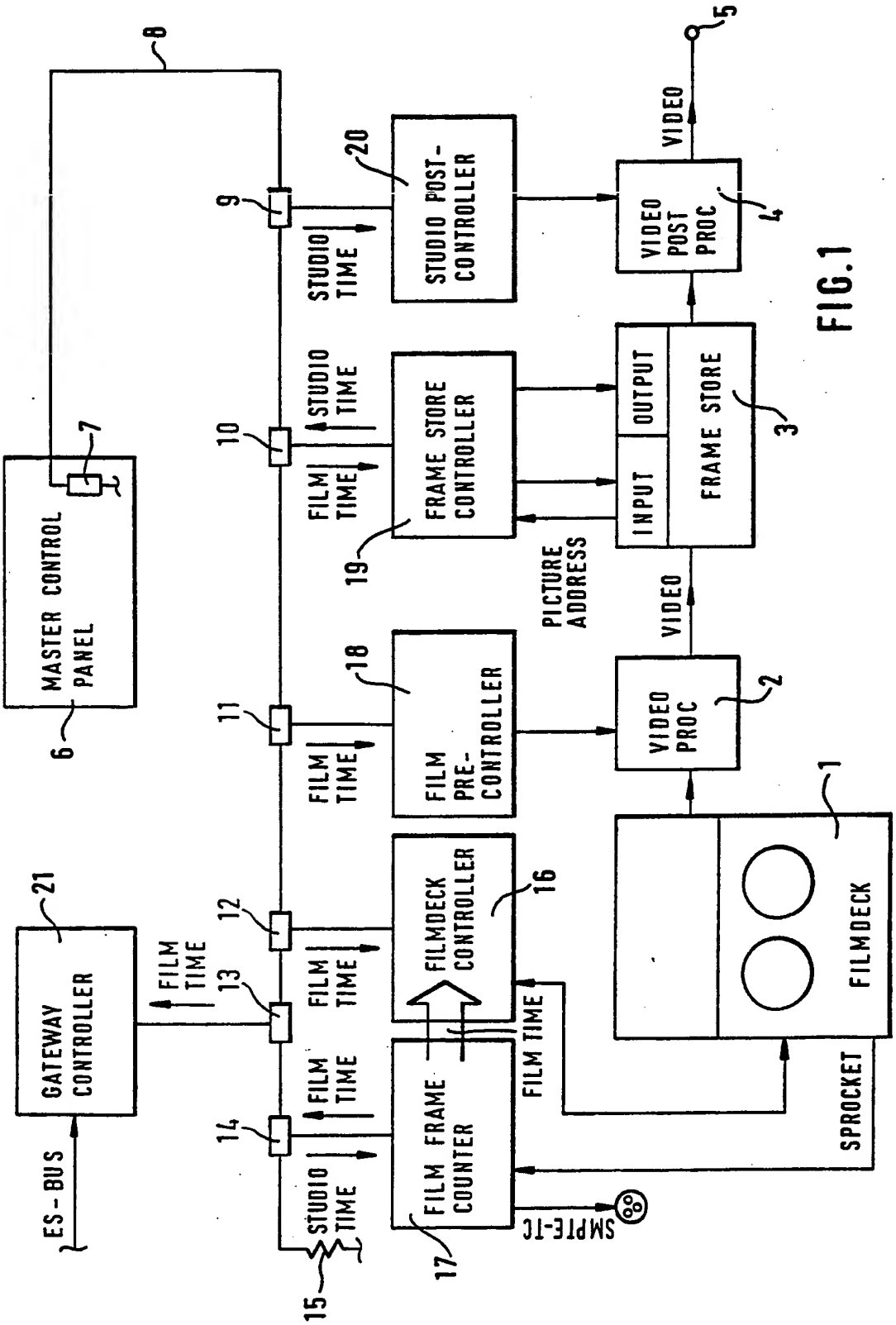
ES-BUS
GATEWAY CONTROLLER
21
FILM TIME
MASTER CONTROL PANEL
6
7
8
9
10
11
12
13
14
15
STUDIO TIME
FILM TIME
FILM FRAME COUNTER
17
FILMDECK CONTROLLER
16
FILM PRE-CONTROLLER
18
FRAME STORE CONTROLLER
19
STUDIO POST-CONTROLLER
20
PICTURE ADDRESS
SMPTE-TC
FILMDECK
SPROCKET
1
VIDEO PROC
2
FRAME STORE
INPUT
OUTPUT
3
VIDEO POST PROC
4
VIDEO
5

FIG.1

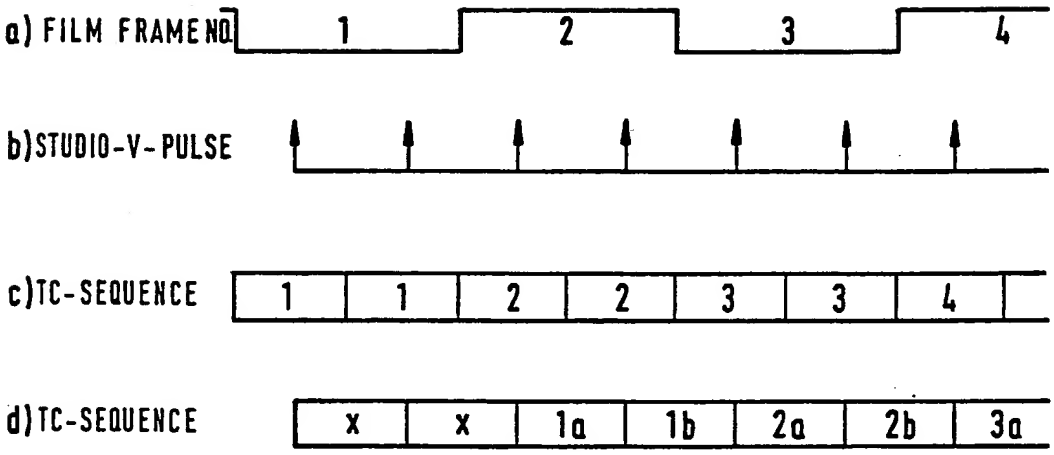
a) FILM FRAME NO.
1
2
3
4
b) STUDIO-V-PULSE
c) TC-SEQUENCE
1
1
2
2
3
3
4
d) TC-SEQUENCE
x
x
1a
1b
2a
2b
3a

FIG. 2

METHOD FOR CONTROLLING FUNCTIONAL UNITS WITHIN A TELEVISION STUDIO APPARATUS

This invention relates to a method for controlling functional units within a television studio apparatus.

The journal "Fernseh- und Kino-Technik", No. 5, 1989, pp. 251 to 262 discloses a machine-internal control system for VTR equipment, in which a local area network constructed on the basis of IEEE standard 802.3 (Ethernet/Cheapernet) transmits machine instruction sets of the so-called ES-bus (EBU-Standard-Tech. 3245-E). System blocks connected to the local network do not apply to video signal-related functional units.

In addition, US Patent Specification No. 4,689,683 discloses a system for the central control of a studio for film and television productions. The individual studio units, such as for example film scanners, VTR equipment, television cameras, etc. are connected to one another via both an analog and a digital local area network. The analog, multichannel local network is used for transmitting video and audio signals and the digital local network for transmitting data for the control of the individual units.

The control data is transmitted between the units by means of associated interface components, which are connected into the bus line of the digital network. The interface components contain inter alia time code and instruction generators, a time code receiver, instruction decoders and access controllers. A central computer also connected to the digital local network can consequently control access of the units connected to the two local networks in an address and time code-dependent manner.

The object of the present invention is to provide a method of controlling functional units provided for processing video signals, in which delays in the video signal provided by such units is precisely compensated.

According to the present invention there is provided a method for controlling functional units within a television studio apparatus, wherein functional units provided for video signal processing are connected in series and are also connected via respective interfaces to a local area network with a serial bus on which there are transmitted data blocks containing control data for the functional units, wherein in the data blocks an SMPTE time code is associated with the control data for the functional units, wherein the control

data for functional unit(s) addressed by a data block is accepted by such unit(s) in time-dependent manner according to the SMPTE time code value contained in the data block, and wherein functional unit(s) which delay the video signal produce modified data blocks for series-connected functional units in which the time code value is delayed compared to the received time code value by the amount the video signal is delayed in the relevant functional unit.

It is particularly advantageous if a film picture or image-synchronous time code is used. The time code value is modified by a functional unit, if the latter causes a video signal delay. In this case the time code value is delayed by the amount of the video signal delay, so that a series-connected, video signal-processing functional unit is supplied with an image-precise time code with respect to the parallel transmitted video signal.

An embodiment of a method according to the present invention will now be particularly described by way of example with reference to the accompanying drawings, wherein:

Figure 1 is a block circuit diagram of a film scanner which operates according to an embodiment

of the invention, and

Figure 2 are timing diagrams for illustrating the operation of the film scanner of Figure 1.

Referring to the drawings, in the block circuit diagram of Figure 1 a film scanner has a film drive mechanism 1 in which it is assumed that a transport mechanism continuously moves the film. In the case of a film projector and a dichroic prism, the three (red, blue, green) colour components of each film frame are imaged on a respective linear semiconductor CCD array, and the primary colour signals obtained at the output of the semiconductor arrays are in known manner pre-amplified, matrixed, equalised and balanced in a functional unit 2. The thus prepared primary colour signals are written into an image or frame store 3 for conversion into a standard-correct television signal with interlaced scanning, and are subsequently read out field-by-field in synchronism with studio timing. The now studio-synchronous primary signals are further processed in another functional unit 4, so that ultimately a coded colour video signal is available at the terminal 5.

The control of the series-connected functional units, namely the film drive mechanism 1, the

functional unit 2, the frame store 3 and the functional unit 4, is effected by control data which is inputted by the keyboard (not shown) of a control console 6, and is supplied via an interface bus 7 to a bus system 8 of a local area network. Further interfaces 9, 10, 11, 12, 13 and 14 are connected to the bus system 8.

The interfaces 7 and 9 to 14 are used for transmitting and receiving data blocks. The format of the data blocks in the present embodiment corresponds to IEEE standard 802.3, in which, for each data block, there are 8 bits constituting a preamble, 6 bits each for target and source addresses, 2 bits for the length and 46 to 1518 bits for the data, as well as 4 bits for cyclic redundancy block protection. The data block transmission rate is 10 Mbit/s. Further details thereon can be found in our German Patent Application No. P 37 16 318. This application describes a unit-internal system for transmitting data and information. Advantageously it is possible to use for this system inexpensive IC sets of the mutually protocol-compatible Ethernet and Cheapernet. The bus system 8 is terminated with e resistor 15.

The film drive mechanism 1 is controlled by a drive mechanism controller 16, which is connected

to the interface 12. The drive mechanism controller 16 inter alia controls the aforementioned film transport means. Feedback information concerning the particular film frame which has just been scanned is provided by counting the film perforations with a film frame counter 17. A film time code is produced, which corresponds to the standardized SMPTE time code, and is related to the position of the film in the scanner at any given moment. The film information can alternatively be taken directly from the film if a film time code is alrady optically recorded on the film material. The interface 14 connected to the frame counter 17 transmits the film time code thus produced via the bus system 8 and the interface 12 to the drive mechanism controller 16. Depending on the addressing, further stages connected to the bus system 8 are also available responsive to the film time code. One of these stages is the controller 18, which is connected to the interface 11 and which supplies the functional unit 2 with setting parameters. However, the data of the setting parameters received from the bus system 8 is not immediately accepted by the unit 2; this only takes place following a frame change, which is defined by the film time code. Thus, in the present case the control of the unit 2 can only be changed every frame period.

The frame store 3 is controlled by a frame store controller 19, which obtains its control data from the interface 10. The frame controller 19 produces addresses for the writing in and reading out of the frame store 3. The latter has a storage capacity of 2 film frames. The video signal from the unit 2, corresponding to the current film frame being scanned, is continuously written in, under the control of the film time code, to one half of the store, whilst the preceding film frame is read out, in studio-synchronous manner under the control of a studio sync signal, from the other half of the store. The read-out of the current film frame takes place in studio-synchronous manner as from the next field change.

The diagrams provided in Figure 2 illustrate this process. Line a in Figure 2 shows the time sequence of consecutive film frames, which are numbered 1 to 4. The associated film time code has the sequence of values shown in line c. In the case of the studio-synchronous reading out of the frame store 3, the studio vertical frequency sync signal shown in line b is used, for example. As a result of the delay by a frame period and the studio time code not being synchronous with respect to the film time code, the video signal is delayed with respect to the film time code. According to the embodiment of

the invention, a new time code d for the series-connected functional unit 4 is produced in the frame store controller 19. The value of the new time code is delayed by the amount by which the video signal is delayed in the frame store 3. A controller 20 for the functional unit 4 connected to the interface 9 is thus triggered in time-correct manner with respect to the video signal, for acceptance of the setting parameters. It is therefore possible to avoid a faulty control of the function groups in the video signal path due to the conflicting clock rasters.

To the interface 13 there is connected a gateway controller 21, which responds to the film time code. The function of the gateway controller 21 is the adaptation of other transmission protocols, for example the ES bus, to the transmission protocol of the Ether/Cheapernet protocol used in the present embodiment.

It will be understood that the method according to the present invention is applicable far more widely than described above. It may be used in studio apparatus where for example more than one functional unit provides a delay for the video signal, and/or where more than one functional unit is the recipient of a delayed time code.

CLAIMS

1. A method for controlling functional units within a television studio apparatus, wherein functional units provided for video signal processing are connected in series and are also connected via respective interfaces to a local area network with a serial bus on which there are transmitted data blocks containing control data for the functional units, wherein in the data blocks an SMPTE time code is associated with the control data for the functional units, wherein the control data for functional unit(s) addressed by a data block is accepted by such unit(s) in time-dependent manner according to the SMPTE time code value contained in the data block, and wherein functional unit(s) which delay the video signal produce modified data blocks for series-connected functional unit(s) in which the time code value is delayed compared to the received time code value by the amount the video signal is delayed in the relevant functional unit.

2. A method as claimed in claim 1, wherein the control data is accepted by the functional units at a frame or field change.

3. A method as claimed in claim 1 or 2, wherein the control data is for functional units of a film scanner in which a video signal produced by scanning a film is written in frame-synchronous manner into a store and is read out of said store coupled to a studio sync signal, and wherein there are derived two time codes in which for functional units located upstream of the store there is derived a first time code value related to the film position and in which for functional units located downstream of the store there is derived a second time code related to the studio sync signal.

4. A method as claimed in claim 1, wherein the local area network transmits the data blocks according to a protocol laid down in IEEE standard 802.3.

5. A method as claimed in claim 1, wherein the data is in accordance with the provisions of EBU standard Tech. 3245-E.

6. A method as claimed in claim 1, substantially as described with reference to the accompanying drawings.

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